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POLYCHAETES OF THE NEW YORK BIGHT: A KEY AND A DISCUSSION OF THE ECOLOGY OF THE DOMINANT SPECIES

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Polychaetes of the New York Bight: A Key and a Discussion of the Ecology of the Dominant Species

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ABSTRACT

The major portion of this report is an identification key to the polychaetes of the New York Bight. The key covers polychaetes collected on six surveys at a site twelve miles south of Fire Island. An introduction to the key defines terms which may be unfamiliar. A discussion of the data and a summary of the life histories of the five most common polychaetes in the samples follows the key. Possible relationships between life histories and abundance are suggested.

INTRODUCTION

The adverse biological effects of dumping sewage and dredge spoils in the oceans have stimulated much interest and research in recent years. Most investigations of this problem have included studies of bottom-living or benthic animals, since it is generally agreed that benthic organisms are the best biological indicators of this kind of pollution (Butcher, 1955). Dumping sewage sludge may create abnormal benthic communities by greatly reducing species diversity and standing crop (NOAA, 1972). Death of organisms may be caused by smothering, intolerably low oxygen concentrations in the sediments due to highly reducing organics in the wastes, or by the toxicity of heavy metals or other substances in high concentrations in disposal areas.

The New York Bight is used extensively for waste disposal. However, only a few studies of the species diversity and abundance of benthic animals have been carried out in this area. The EPA's Coastal Pollution Research Program has been conducting a long-term study of the benthic fauna of a proposed experimental dump-site in the New York Bight since 1972. With information on the benthic communities in an area before, during, and after sludge dumping a clearer understanding of the biological effects of sludge dumping will be possible. I have been involved in the identification and enumeration of one group in the benthic community, the polychaetes, or marine annelids. The animals come from samples collected during cruises in 1972, 1973, and 1974 in the New York Bight twelve miles south of Fire Island. Polychaetes are an appropriate organism for the New York Bight baseline study since they are ubiquitous, diverse, and abundant, and pollution-caused changes might be expected to be readily detectable.

In any faunal survey, correct identification of animals is fundamental. As an aid to future similar projects, an identification key for polychaetes in the New York Bight is presented in this report. This key draws heavily from Berkeley, 1948; Gosner, 1955; Pettibone, 1968; and Smith, 1968. It is supplemented with my own observations which may make some identifications easier. The key is restricted to the polychaetes we have encountered in our samples. We feel justified in this since the sampling program has been extensive and it is unlikely that any major component of the polychaete community has been left out. It may be necessary to use more complete keys to identify rarely-encountered worms. Drawings are included to assist in identification. A series of photomicrographs of the common polychaetes is available from the Coastal Pollution Research Program. A general discussion of some of the polychaete data is included in the report. The abundance and diversity are treated with respect to time. Some features of the life histories of the most common forms are mentioned. Possible relationships between their life histories and abundance are discussed.

INTRODUCTION TO THE KEY

Polychaetes may be distinguished from other worm-like animals by the presence of usually distinct segmentation, trunk appendages, cephalic (head) appendages, and bristles. On only a few genera is segmentation indistinct. Polychaetes assume a wide diversity of morphological forms, from thread-like to conical. Bodies may or may not be regionated (divided into distinct regions), and regionation may be correlated with sexual activity. Usually the head and tail ("prostomium" and "pygidium") are recognizable.

Head appendages are helpful in making identifications. Unfortunately, the terminology of these appendages has not been completely standardized. "Antennae" or "tentacles" are usually dorsal appendages on the prostomium. "Palpi" ranging from filamentous to globular, are usually ventral and border the mouth. True gills may be found on the head, but may not be easily recognizable as such. Many polychaetes have an eversible proboscis, a modified part of the foregut.

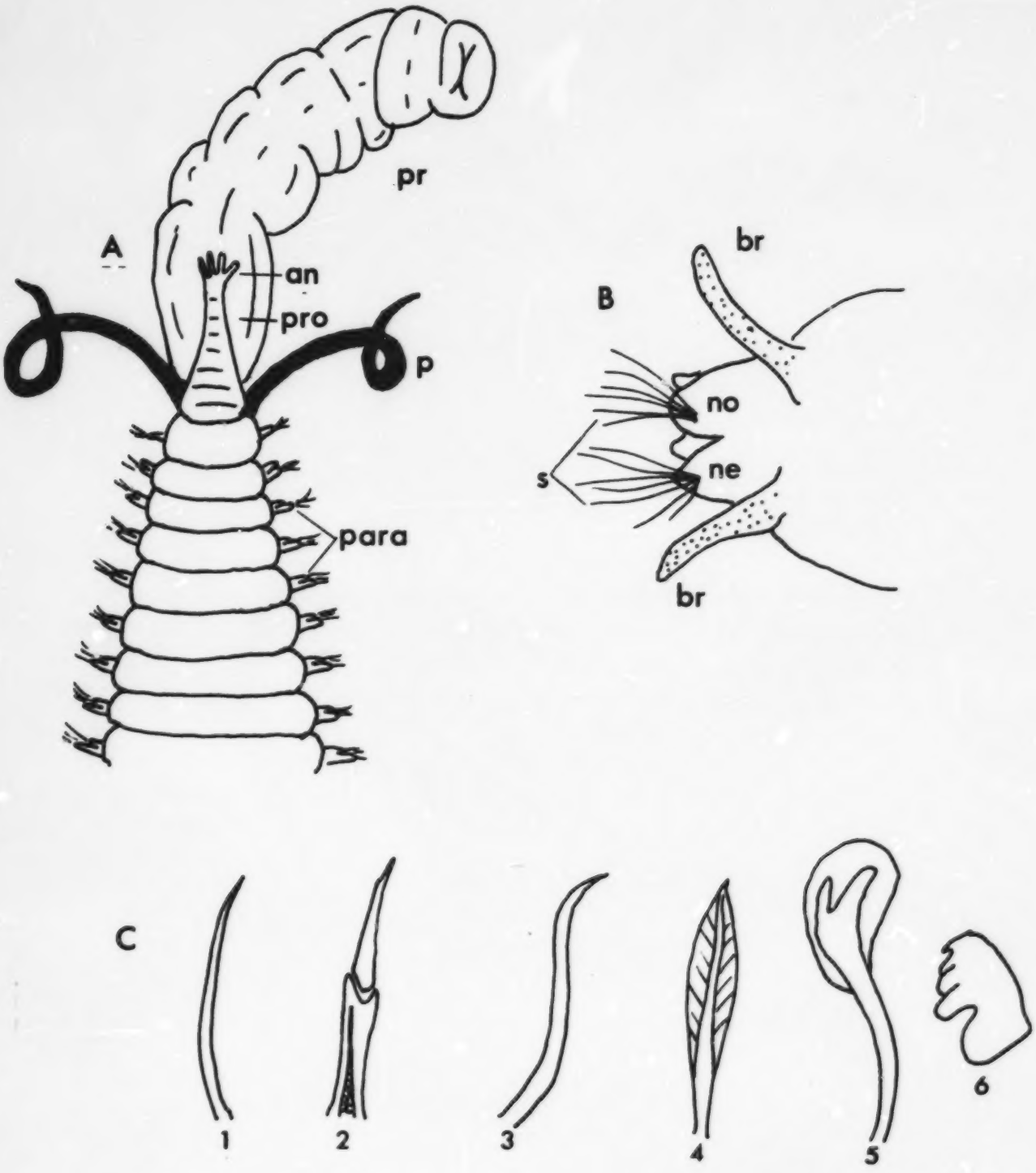
The characteristic trunk appendages, "parapodia," are also useful in making identifications. Parapodia may be simple "uniramous" structures with a single lobe or "biramous" with a dorsal lobe, the "notopodium", and a ventral lobe, the "neuropodium". Structures which may be on the parapodia include "branchiae" (gills), "elytra" (scales), or "setae" (bristles). Parapodia are commonly well developed in active, swimming polychaetes, and reduced in more sedentary species.

The most helpful structures on the parapodium for identification are the setae. Setae, present in almost all polychaetes, usually occur in bundles with a supporting structure called an "aciculum." Setae assume a wide variety of forms, and provide very precise characters for species identification. The initial distinction is between "simple" (a

single piece) and "composite" (two or more pieces) setae. "Capillary" setae are long and slender. The ends of setae may be "entire," "bifid," or "trifid," depending on whether there are one, two or three tips. "Falcate" refers to setae bent like a sickle, "limbate" to setae flattened like an oar blade. Stubby, bent tips are called "hooks" or crochets." These setae grade into short, broadened "uncini." The tips of both simple and compound setae may be embedded in a clear matrix ("hood"). These types of setae and the other morphological characters discussed are illustrated in Figure 1.

Figure 1:

A. Generalized polychaete, anterior end; pr - proboscis; an - antennae; pro - prostomium; p - palp; para - parapodia. B. Generalized parapodium. br - branchia; no - notopodium; ne - neuropodium; s - setae. C. Setae. 1 - simple, capillary; 2 - composite; 3 - falcate; 4 limbate; 5 - mooded crochet; 6 - uncini.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DICUSSION

The data will be discussed first, followed by a discussion of the life histories of the dominant polychaetes in the New York Bight and possible relationships between the abundance and life history of these species.

The data was collected on six cruises between December, 1972, and February 1974. From one to nine stations were sampled on each cruise. The numbers of the five most abundant polychaetes for each cruise are listed in Table 1. The spionid Spiophanes bombyx was the most abundant over the six cruises, the maldanids (bamboo worms) Clymenella zonalis, Leiochone dispar, and Nichomache lumbricalis, were second, third, and fifth most abundant, respectively, whie the goniadid Goniadella gracilis was fourth most abundant.

There were dramatic changes in the number of each species from cruise to cruise. Spiophanes bombyx, present only in moderate numbers in the first three cruises, far outnumbered other species in cruises 4, 5, and 6. Spiophanes bombyx is so numerous in the latter three samples that over the six cruises there were five times as many of these worms as the nearest competition, Clymenella zonalis. On the average, Spiophanes bombyx accounted for 75% (by number) and Clymenella zonalis 10% of the total number of polychaetes from cruise 4. The respective percentages for Cruise 5 were 65% and 12%, and for cruise 6, were 22% and 5%. For all three cruise totals and for most of the station totals within the cruise totals, these two worms were the most and second most abundant species. The increasing dominance of Spiophanes bombyx in later cruises is also reflected in the diversity indices of the cruise totals. The average indices (H'), calculated according to Lloyd, Zar, and Karr (1968), ranged from about .9 in the first three cruises to about .45 in the latter threee. Since the number of species for each

cruise was relatively constant, the decrease in diversity index values indicates that one or a few species dominated the samples in the last three cruises, while the samples from the earlier cruises are made up of a more even distribution of different species.

The polychaetes possess a diversity of habitats and feeding methods. The group has been divided into Errantia (active forms) and Sedentaria (sendentary forms) in the past, but this division is regarded as artificial by taxonamists today. Crawling forms may live on the substrate surface beneath stones, and shells. Burrowing forms occupy fixed or temporary burrows excavated in the substrate. The tube-dwelling habit is common in polychaetes, and is most characteristic of the more sedentary forms. There are a few pelagic forms.

Most marine annelids feed on plankton or detritus. The remainder are predators, and eat other worms, crustaceans, etc. "Plankton feeders" utilize mucus-covered gills to entrap microscopic organisms which are then carried down channels to the mouth. "Direct-deposit feeders" consume the substrate (with organic material that has settled to the bottom) directly by means of the nonmuscular proboscis which is everted by a pressure increase in the coelomic fluid. Polychaetes that feed in this way are burrowers or tube dwellers. "Indirect-deposit feeders" have specialized head structures in place of a proboscis. These structures are covered with mucus to which deposit material adheres. Entrapped material is transported to the mouth along ciliated tracts. "Raptorial feeders", or carnivores, capture their prey by means of an eversible proboscis with two or more chitinous jaws.

The spionids are sedentary, tubiculous (tube-dwelling) worms. They live in membraneous, mud or sand covered tubes. Feeding habits for these polychaetes are transitional between indirect-deposit feeding and filter-feeding. Spionids feed on the bottom, sweeping the substrate for

microscopic suspended material with a pair of elongate palps. Clymenella zonalis, Leiochone dispar, Nichomache lumbricalis, and other "bamboo worms" (so-called because of elongated segments resembling bamboo) are tubiculous, burrowing, sedentary, polychaetes. The tubes are soft and encrusted with sand, mud, or shell. Bamboo worms are typical direct-deposit feeders. They live upside-down and ingest the substrate at the bottom of their tubes. The organic portion is digested, and the mineral portion egested as castings. The bamboo worms, unlike most other polychaetes, which have gills, respire by the diffusion of gases through the body surface.

Gonaidella gracilis and other goniadidae are active fast-moving polychaetes. They are usually found on sand, fine gravel, or soft mud substrates. Goniadella gracilis is a raptorial feeder. Both glycerid and goniadid polychaetes can tolerate extremes of environmental conditions.

The five species of polychaetes listed in Table 1 are very important to the benthic community of the New York Bight. They represent a range of habitats and feeding habits. This may be indicative of a relatively "clean" environment in which no one group of polychaetes is selected for. Reish (1955) tried to establish the relationship between benthic polychaetes and zones of pollution in the Los Angeles Long Beach harbor. He divided the harbor into five zones ("healthy" through "very polluted") on the basis of bottom conditions and the distribution of polychaetes. Perhaps the "Spiophanes bombyx - Clymenella zonalis" aggregate represents a "healthy" zone. Other distinctive polychaete aggregates may emerge as sewage sludge dumping is initiated and continued in this area.

The numbers of polychaetes vary greatly spatially and temporally. Spiophanes bombyx, for example, is scarce in some samples, and overwhelmingly abundant in others. When the data from several cruises is combined, however, a few dominant species emerge which may be used as a baseline against which to compare future pollution-induced changes in the benthic community.

Table 1

Numbers of the Five Most Abundant Species of Polychaetes for Six Cruises in the New York Bight

Cruise	1	2	3	4	5	6	Totals
Spiophanes bombyx	2	27	27	1063	2729	1213	5061
Clymenella zonalis	65	158	38	74	348	315	998
Leiochone dispar	23	48	2	51	117	109	350
Goniadella gracilis	83	33	8	12	62	55	253
Nichomache lumbricalis	14	23	11	25	15	27	115
Totals	187	289	86	1225	3271	1719	6777

THE KEY

1. Dorsal surface covered with enlarged scales or elytra which may be concealed by a dense coating of felt or furlike setae, or dorsum with bristles in transverse ridges. GROUP 1. Families: Sigalionidae, Polynoidae.

NOTE: Scales may not be obvious, or many may be absent.

1. Without scales or elytra, Segmentation distinct, Anterior end with antennae minute or absent or with a single median antenna; tentacular cirri or palpi short or absent. 2. Anterior end with well-developed appendages including antennae, tentacles, palpi, or tentacular cirri. 5.

2. Prostomium either conical with 4 minute, terminal antennae or more or less quadrangular with four small antennae. GROUP 2. Families: Nephtyidae, Glyceridae, Goniadidae.

2. Not So - 3.

3. Body not regionated; body segments not conspicuously longer than wide; postomium conical, without appendages or with a median antenna. GROUP 3. Families: Lumbrineridae, Arabellidae, Paraonidae.

3. Body usually more or less regionated, or with some body segments much longer than wide; prostomium varies 4.

4. Some body segments much longer than wide; anterior end more or less obliquely flattened or bluntly rounded and hoodlike, without appendages or with a frilled membrane. GROUP 4. Families: Maldanidae, Oweniidae. "Bamboo worms."

4. Segments shorter than or little longer than wide; anterior end conical or with T-shaped or trilobed prostomium, without appendages or with papillae. GROUP 5. Families: Arenicolidae, Capitellidae, Scalibregmidae, Opheliidae, Orbiniidae.

NOTE: Certain spionids, such as Spiophanes bombyx have a T-shaped prostomium, and as the two long palpi are often absent, may be mistaken for worms in this group.

5. Typically wormlike forms, elongate; with body segments more or less alike throughout, not distinctly regionated; prostomium usually well developed; parapodia well developed for active crawling or swimming. 6.

5. Body relatively "short, stout," often regionated; prostomium often reduced or hidden by a concentration of numerous tentacular appendages or setae; parapodia frequently reduced; chiefly burrowing, tubicolous forms: 8.

6. Parapodia uniramous, with leaflike or globular dorsal and ventral cirri; 4 or 5 antennae; no palpi; 2-4 tentacular cirri; usually two eyes; proboscis jawless but with papillae. GROUP 6. Family: Phyllodocidae.

6. Parapodia uni or biramous, cirri when present not as above; antennae 1-7 but not 4 or 5; usually with two palpi with may be globular; with 1-8 pairs of tentacular cirri or none. 7.

7. With two frontal antennae; a pair of two-jointed palpi; three or four pairs of tentacular cirri; usually four eyes; proboscis with a collarlike "oral ring" and a "maxillary ring" with a pair of sicklelike jaws; GROUP 7. Family: Nereidae.

7. With 1-7 antennae; two globular palpi or none; one or two pairs of tentacular cirri or none; proboscis with complex jaw pieces. GROUP 8. Families: Dorvilleidae, Onuphidae.

8. Head with two long palpi and sometimes with one or a few pairs of filamentous branchiae, but without numerous filamentous appendages; if palpi short, then appendages at midbody modifies to form three large circular pallets. GROUP 9. Family: Spionidae.

8. Head usually with numerous bristles or tentacular appendages. 9.

9. Anterior end with tentacular appendages which are pinnate and concentrated in two semicircular or spiral lobes; GROUP 10. Family: Sabellidae. Known as "fan-worms" because of appearance of the tentacular appendages.

9. Anterior end with numerous tentacular appendages which may be pinnate or not, but which are not concentrated in two distinct lobes. 10.

9. Body covered with papillae; anterior end usually with setae directed forward and frequently forming a sort of cage; head not conspicuously truncated; GROUP 11. Family: Flabelligeridae.

10. Tentacular appendages usually originating back of the head; body not regionated. GROUP 12. Family: Cirratulidae.

10. Tenacular appendages at head end, frequently with a clump of gills behind the tentacles; body regionated. 11.

11. Tentacular appendages not retractile. GROUP 13. Family: Terebellidae.

11. Tentacular appendages retractile. GROUP 14. Family: Ampharetidae.

GROUP ONE Sigalionidae. Polynoidae. Dorsum covered by scales which are not concealed; Dorsum without transverse rows of setae.

1. With dorsal cirri on segments without elytra - Polynoidae. With 30-50 pairs of elytra; 100 mm by 9 mm; commensal with terebellid polychaetes. Lepidametria commensalis.

1. Without such dorsal cirri, but most genera, except Pholoe, with cirriform branchiae on all segments except anterior few. Sigalionidae. 2.

2. With cirriform branchiae; burrowing species. 3.

2. Without cirriform branchiae; 25 mm by 4 mm; a creeping form. Pholoe minuta.

3. Prostomium without median antenna; elytra with an external fringe of pinnate papillae; 300 mm by 8 mm. Sigalion arenicola.

3. Prostomium with median antenna. Several types of neurosetae. Anterior elytra fringed, posterior ones notched. 100 mm by 4 mm. Sthenelais limicola.

GROUP TWO: Nephtyidae, Glyceridae, Goniadidae.

1. Body cylindrical; parapodia small, without lamellae; prostomium conical with four minute terminal antennae. 2.

1. Body flattened; parapodia well developed, with lamellae; prostomium subquadrate with four small antennae. Tentacular segment with setae and a pair of ventral tentacular cirri. Nephtyidae 5.

2. Body regionated, with a short anterior section with uniramous parapodia and posterior parapodia distinctly biramous; individual segments with one annulation; proboscis eversible, long cylindrical, covered with papillae and armed with complex accessory structures usually in the form of chevrons, circlets, or bands. Goniadidae. 4.

2. Body not regionated, the parapodia essentially similar throughout; individual segments with 2 or 3 annulations; proboscis eversible, with four strong jaws. Glyceridae. 3.

3. Parapodia with 1 post setal and 2 presetal lobes. No branchiae. 150 mm by 8 mm. Glycera capitata.

3. Parapodia with 2 postsetal and 2 presetal lobes. Branchiae not retractile. 370 mm by 11 mm. Glycera dibranchiata.

4. Presetal lobes of neuropdia bilobed. Proboscis with minute papillae, a terminal ring of larger papillae and 3-8 teeth. Proboscis with chevrons. Lacks a transitional body region. Has 7-11 chevrons and reaches 160 mm. Goniada brunnea.

4. Presetal lobes of neuropoda simple, not bilobed; proboscis with patches of minute papillae. Proboscis with basal chevrons; neurosetae include compound falcigers and spinigers; 50 mm x 1 mm. Goniadella gracilis.

5. With branchiae curving inwardly. Aglaophamus.

a. With 2 minute eyes; neuropodia with an erect lobe or cirrus above; 44 mm x 3 mm. Algaophamus verrilli.

b. Without eyes, no neuropodial lobe. Aglaophamus circinata.

5. With branchiae curving outwardly. Nephtys 6.

6. With equal dorsal and ventral tentacular cirri. 7.

6. With a ventral tentacular cirrus only. 300 mm x 20 mm. Nephtys picta, Nephtys bucera.

7. Branchiae wide, foliaceous; 200 mm by 13 mm. Neptys paradoxa.

7. Branchiae cirriform; not inflated basally. Posterior parapodial long: both noto- and neuropodial lamellae foliaceous throughout body. 250 mm x 15 mm Nephtys caeca.

GROUP THREE: Lumbrineridae, Arabellidae, Paraonidae.

1. Parapodia with projecting setal lobes supported by internal acicula.
2.

1. Parapodia without projecting setal lobes and without internal acicula Paraonidae. 5.

2. Neurosetae include hooded crochets. Lumbrineridae. Parapodia without branchiae. Lumbrineris 3.

2. Neurosetae do not include hooded crochets. Arabellidae. Parapodia with heavy acicular setae; 4 eyes, prostomium conical; 110 mm x 4 mm. Notocirrus spiniferus.

3. Anterior parapodia with compound crochets. 300 mm x 5 mm; acicula yellow. Lumbrineris latreilli.

3. Parapodia without compound crochets. 4.

4. Acicula yellow.

   a. Prostomium 2 or 3 times longer than wide; 40 mm by 1 mm. Lumbrineris acuta.

   b. Prostomium much shorter.

      - Anterior hooded crochets with long "wings". Lumbrineris impatiens. Reach 400 mm.

- Anterior hooded crochets short "wings", reach 150 mm. Lumbrineris tenuis.

4. Acicula black. 380 mm by 12 mm; maxillae II with 4 or 5 teeth. Lumbrineris fragilis.

5. With a dorsal, median antenna. Aricidea.

a. Antennae extending to about setigers 4-6; 6 mm by 0.6 mm. Aricidea quadrilobata.

b. Antennae extending to about setiger two at most. Whitish. 20 mm by 1.5 mm. Aricidea suecica.

5. Without a median dorsal antenna. Paraonis.

- With capillary setae only on notopodia. Strap-like branchiae beginning on setigers 6-7; 25 mm x 0.5 mm Paraonis gracilis.

GROUP FOUR: Maldanidae, Oweniidae.

1. Anal segment with a funnel, flattened plate, or spoon-like; prostomium hood-like or with a flattened plate. Maldanidae. 2.

1. Anal segment simply rounded. Oweniidae.

- Prostomium lacks deeply lobed branchial membrane; Prostomium rounded, mouth ventral and oblique; about 27 segments, first abdominal ones very long, shorter posteriorly; 30 mm x 1.5 mm. Myriochele heeri.

2. Prostomium with distinct fringe or rim, more or less tilted posteriorly. 4.

2. Prostomium without distinct fringe or rim. 3.

3. Some segments with collars; first setigers long. Rhodine attenuata.

3. Without collars; first setigers short; pygidium cup-or funnel-like:

a. Pygidium with 15-25 cirri and central anus; 160 mm x 5 mm; with 22 or 23 setigers; Nichomache Lumbricalis.

b. Pygidium with 1 long ventral cirrus, 2 short lateral ones; and additional papillae or tooth-like projections with anus at the summit of a central cone; 50 mm x 2.5 mm with 18 setigers. Leiochone dispar.

c. Pygidium with a concave, lobed plate without cirri, Petaloproctus tenuis.

4. Pygidium oblique, platelike, with anus dorsal; Asychis biceps, Maldanopsis elongata.

4. Pygidium distinctly funnel-shaped with central anus.

a. Distinct bands in the midregion and a ventral spot on the pygidium. 20 mm. Clymenella zonalis.

b. Lacks spot and bands, Clymenella torquata. Has "collarette" on 4th setiger.

GROUP FIVE: Arenicolidae, Capitellidae, Scalibregmidae, Opheliidae, Orbiniidae. Parapodia with capillary setae or some with rows of crochets on low mounds anteriorly.

1. Prostomium T-shaped with only 4 pairs of branchiae, limited to a few anterior segments. 75 mm. Scalibregma inflatum.

1. Prostomium conical, rounded, or oval. 2.

2. Parapodia reduced to bundles of setae; body slender with ventral groove which extends from segments 10 to 12 posteriorly. 18 pairs of crenulated branchiae. Ophelia denticulata.

2. Parapodia with well developed and complex parapodia varying in detail on detail on different parts of the body. 3.

3. First 1 or 2 segments behind prostomium without appendages or setae. Orbiniidae. 4.

3. First segment with appendages and setae; no branchiae; prostomium with tentacular palpi which are contractile and easily broken off. 12 mm or more by 2 mm. Apistobranchidae.

4. Prostomium truncated, oval or rounded; 80 mm x 3 mm Naineris quadicuspida.

4. Prostomium conical. 5.

5. Thoracic neuropodia with postsetal lobes fringed with papillae; branchiae begin on setigers four through six. Orbinia 7.

5. Thoracic neuropodia without fringed postsetal lobes; branchiae begin on setigers 9-32. Scoloplos 6.

6. Branchiae begin on setigers 5 or 6; thoracic neuropodia with thick spine-like setae; 65 mm. Scoloplos rubra.

6. Branchiae begin on setigers 8-32. Without interramal cirri. One or two subpodial papillae. 120 mm x 2.5 mm. Scoloplos armiger.

7. Thoracic segments without spear-like spines.

   a. With ventral cirri on abdominal parapodia; 50 mm x 3 mm. Orbinia swani.

   b. Without ventral cirri on abdominal parapodia; 250 mm x 7 mm. Orbinia ornata.

GROUP SIX: Phyllodocidae

1. With two pairs of tentacular cirri; prostomium subtriangular. Eteone. 3.

1. With 4 pairs of tentacular cirri; prostomium heart-shaped with posterior notch. Prostomium with 4 frontal antennae; no median antenna. Phyllodoce. 2.

2. Ventral cirri oval.

   a. 100 m x 2 mm. Phyllodoce maculata.

   b. Ventral cirri oval; asymmetrical acuminate tip; 450 mm x 9 mm. Phyllodoce groenlandica.

2. Ventral cirri tapered.

   a. Has a more or less longitudinal dark band. 150 mm x 3 mm. Phyllodoce mucosa.

   b. Transverse dark bands; 100 mm x 2.5 mm Phyllodoce arenae.

   c. Dorsum green with median dark stripe. Phyllodoce panamensis. (Very close to Ph. arenae. May be a subspecies).

3. Ventral pair of tentacular cirri two or three times longer than dorsal pair; anal cirri tapering; 230 mm x 3 mm. Eteone lactea.

3. Dorsal pair of tentacular cirri twice as long as ventral pair; anal cirri elongate-oval; 10 mm x 1 mm. Eteone trilineata.

3. Dorsal and ventral pairs subequal or ventral slightly longer.

a. Anal cirri tapering; parapodia with asymmetrical dorsal cirri. 93 mm x 3 mm. Eteone heteropoda.

b. Anal cirri almost spherical. Eteone longa.

GROUP SEVEN: Nereidae. Parapodia biramous, with four pairs tentacular cirri; ventral cirri single, prostomium pear-shaped.

1. Proboscis with horny, conical paragnaths lacking on areas VII-VIII. Notopodia of middle and posterior regions with spinigers and falcigers. Commensal with Maldanopsis elongata. Nereis grayi.

1. Paragnaths more numerous, present on areas VII-VIII. Notopodia of middle and posterior regions with spinigers and compound falcigers. With thick, evenly rounded parapodial ligules; 155 mm; littoral and shallow water. Nereis pelagica.

GROUP EIGHT. Dorvilleidae, Onuphidae.

1. First apparent segment without parapodia or setae. First apodous segment with tentacular cirri. Branchiae are simple tendrils. Branchiae on first setiger; tube imbedded with thin, inner, parchment-like lining, and coating of mud; 125 mm x 5 mm, no eyes. Onuphis opalina.

1. First two segments without parapodia or setae. Prostomium with pair of articulated antennae and a pair of ventral palpi. Free-living burrowers or in temporary tubes. Pale pinkish or white. Two pairs of eyes. Stauronereis rudolphi.

GROUP NINE: Spionidae. Body not sharply divided in regions with a gradual transition in segment form. Fifth setiger not modified.

1. Without branchiae. Prostomium with frontal horns, 60 mm x 15 mm. Spiophanes bombyx.

1. With four pairs of smooth branchiae. First and fourth pair of branchiae pinnate. Hooded hooks multidentate. Prostomium rounded in front. No dorsal crest across setiger 7 or 9. Prionospio steenstrupi.

1. With seven or more pairs of branchiae. 2.

2. Branchiae begin on setiger two; 60 mm x 2 mm. Scolecolepis squamata.

2. Branchiae begin on setiger one. With 2 pairs of eyes forming a square; visible dorsally; first few notopodial lobes not serrate. Ventral lamellae greatly reduced; neuropodia with about 16 crochets; 50 mm. Spio setosa.

GROUP TEN: Sabellidae. Tubes flexible, not calcareous, but mucoid, leathery, parchment-like, or rarely undeveloped. With more than 12 setigers. Branchia filaments only united basally.

1. Branchial filaments without eyes; collar lobed; tube leathery, covered with sand or mud. 60 mm x 2-3 mm. Potamilla neglecta.

1. Branchial filaments with eyes. Potamilla reniformis.

GROUP ELEVEN: Flabelligeridae. Body covered with papillae; anterior end usually with setae directed forward and frequently forming a sort of cage; head not conspicuously truncated; not tubicolus. Papillae simple, not pedunculate; neurosetae simple. Without nephridial papillae.

1. Branchiae of two kinds, one filiform, the other wider and flatter, bordering anterior end; neuro-and notosetae capillary; 25 mm by 2 mm. Diplocirrus hirsutus.

1. Branchiae all alike, neurosetae simple. Hooked neurosetae beginning on fourth segment. Pherusa plumosa.

GROUP TWELVE: Cirratulidae.

1. Without large tentacles; with filamentous tentacles in 2 groups or united on dorsal surface of one or two anterior setigers; with pair of long branchiae on most segments. Without eyes. Filamentous tentacles on first and second setigers. Cirratulus grandis.

1. With two elongate, lateral tentacles as well as tentacular appendages. With branchia along entire body. 2.

2. Lack setae on the first three segments bearing tentacular cirri. Setae all of capillary type 15 mm x 7 mm. Tharyx acutus.

2. Setae present on the first 3 segments bearing tentacular cirri. Tharyx setigera.

GROUP THIRTEEN: Terebellidae.

Setae present, including uncini.

1. Two pairs of compound filamentous gills; not tree-like. Numerous eye spots; 200 mm x 10 mm Thelepus cincinnatus.

1. Gills present, at least one of them branching, tree-like. 2.

2. Gill filaments spirally branched, forming a compact tuft or "pom-pom" at end of trunk. Pista cristata.

2. Gill filament dendritically branched. Second pair of lateral lobes not divided. Uncini of first row with long necks and tapered shafts. Pista quadrilobata.

GROUP FOURTEEN: Ampharetidae.

Pygidium with well-developed cirri. Tentacles simple.

1. Nine abdominal segments with uncini; uncini with 5 or 6 teeth; without golden-yellow thoracic setae. 19 mm x 4 mm. Amage auricula.

1. Fifteen abdominal segments with uncini; uncini with 5-7 teeth; with 8-20 pairs of well-developed golden-yellow thoracic setae; 40 mm x 5 mm. Amphicteis gunneri.

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The purpose of the internship program is to bring organizations involved in community and economic development, environmental problems and the humanities together with institutuions of higher education and their students in the West for the benefit of all.

For these organizations, the intern program provides the problem-solving talents of student manpower while making the resources of universities and colleges more available. For institutions of higher education, the program provides relevant field education for their students while building their capacity for problem-solving.

WICHE is an organization in the West uniquely suited for sponsoring such a program. It is an interstate agency formed by the thirteen western states for the specific purpose of relating the resources of higher education to the needs of western citizens. WICHE has been concerned with a broad range of community needs in the West for some time, insofar as they bear directly on the well-being of western peoples and the future of higher education in the West. WICHE feels that the internship program is one method for meeting its obligations within the thirteen western states. In its efforts to achieve these objectives, WICHE appreciates having received the generous support and assistance of the Economic Development Administration; the Jessie Smith Noyes Foundation; the National Endowment for the Humanities; the National Science Foundation; the Division of Education of HEW; and of innumerable local leaders and community organizations, including the agency that sponsored this intern project.

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